DOCUMENT RESUME

ED 465 522 SE 066 128

AUTHOR Davidson, Betty M.; Dell, Geralyn L.; Walker, Harriet
TITLE Teacher Leadership + Learner-Rich Environment = Project Math.
PUB DATE 2002-04-02
NOTE 15p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 1-5, 2002).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150) -- Tests/Questionnaires (160)
EDRS PRICE EDRS Price MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *At Risk Persons; Elementary Education; *Mathematics Curriculum; *Mathematics Instruction
IDENTIFIERS *Accelerated Schools; Learning Environment; Teacher Leadership

ABSTRACT

This paper presents the results of a study conducted to understand what took place in Project Math, a special program developed by teachers who were trained in the Accelerated Schools Project in a Southern school. The Accelerated Schools Project is a comprehensive model of school reform, designed to improve school experiences and achievement for at-risk learners. Project Math resulted in the redesign of the mathematics curriculum and regrouping of students into more successful learning environments. It is concluded that Project Math made important contributions to students' math understanding in the participant school. As a result of lower student-teacher ratios, the participant teacher was able to address the needs of individual students, and students felt encouraged by the individual attention they received from their teacher. In their interviews, students expressed more positive attitudes toward mathematics because of the learner-rich environment provided in Project Math. Classroom teachers also felt more confident in experimenting with new strategies and ideas for teaching math as a result of the interactive workshops. (Contains 13 references.) (MM)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 465 522

B. Davidson

2A

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

TEACHER LEADERSHIP + LEARNER-RICH ENVIRONMENT = PROJECT MATH

Betty M. Davidson
University of New Orleans

Geralyn L. Dell
Archdiocese of New Orleans

Harriet Walker
University of Massachusetts Boston

SE 064 128

Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA, Tuesday, April 2, 2002.

BEST COPY AVAILABLE

Introduction

The math curriculum in schools today should provide students with skills that allow them to become critical thinkers, lifelong problem solvers, and productive, responsible adults. In the past, traditional educational strategies appeared to be sufficient to prepare students to become productive citizens, although women and people of color have been and continue to be underrepresented in the fields of mathematics and science (Schwartz, 1999). As the job market becomes more dependent on computer technology and increasingly demands problem solving abilities, employers are seeking workers who are able to think critically and creatively. The advance of information technology and scientific knowledge has created a society in which "...workers are expected to use more higher order reasoning skills to think and solve problems and be skilled in technology, not just be able to do straight mathematical computations" (Holmes, 1999, p. 2). These changes have put pressure on schools to prepare students who know more than how to compute, but more importantly, understand the mathematical concepts that will be demanded for problem solving in the future.

The pressure of contemporary demands for higher order reasoning skills has lead researchers and educators to question the validity of strategies such as the rote memorization of computational formulas and "skill and drill" practices as effective ways to teach mathematics. Because of the demand for higher order mathematical thinking processes through understanding of concepts, a call for change has materialized at the national level. Many states and school districts have begun the arduous task of improving mathematics education in their communities and, as a result, content-driven systemic school reform in mathematics has emerged as a promising model of improvement.

Some school systems have a history of rejecting any mathematical teaching strategies other than the rote learning of computational skills, while others have historically stressed the deep understanding of mathematical concepts that were once taught as New Math. As a result, national school reform models have made uneven strides in raising student achievement. The Third International Mathematics and Science Study (TIMSS) not only examined the mathematics and science performance of students on standardized tests from 38 nations but also investigated other components such as information on schools, curricula, instruction, lessons, and the lives of teachers and students in order to understand the educational context of mathematical learning. The published results report that, "Despite considerable energy devoted to educational improvement, achievement in mathematics in the U.S. has shown only modest gains since 1983. TIMSS results show little change in 8th grade mathematics achievement between 1995 and 1999" (Third International Mathematics and Science Study, 2000, p. 4).

In response to the concerns for mathematical achievement that have been highlighted by this study and by low nationally standardized test scores in mathematics, school personnel are looking for ways to improve their mathematics programs by enriching and supplementing classroom materials and improving instructional practices. This concern for increasing the understanding of mathematical concepts in order that students show higher achievement on standardized tests has been the driving force behind Project Math, a special program developed by teachers in a school in the Southern United States working within the Accelerated Schools Project. This paper presents the results of a study conducted to understand what took place in Project Math when teachers decided to accept the challenge of preparing their students for the mathematical needs of the future, and the results of their efforts.

Accelerated Schools Project

Teachers working within the framework of the Accelerated Schools Project initiated a program for students who were experiencing difficulty in learning mathematics concepts. Accelerated schools is a comprehensive model of school reform, designed to improve school experiences and achievement for at-risk learners. The standard toward which all accelerated schools strive is to build "...communities of staff, parents, students, district office representatives, and local community members working together to create the best schools for all children so that every child has the opportunity to success as a creative, critical, and productive member of our society." (Hopfenberg, Levin, et al, 1993, p. 17).

The school used in this study, Thornton Elementary School, has been a member of the Accelerated Schools Project for six years. The school population in grades three through six is racially mixed with 121 African American students, 112 White students, and two Asian American students. Approximately 96% of the 225 students were on free or reduced meals for the 2000-2001 school year. There are 27 teachers, paraprofessionals, and support staff.

Using a teamwork process for locating and understanding the extent of school based problems developed by the Accelerated Schools Project known as the Inquiry Process, the administration, faculty, and staff began by completing a data analysis. They compared state and district standards to their students' test scores, portfolios, and report card grades to see how they measured up and determined which students needed innovative assistance in mathematics. Next, a Math Cadre was designed to coordinate the process of intervention using a systematic problem solving approach. In the process, every teacher at the school became actively involved in the decision making process and felt committed to its success. Through their efforts as a team of

professionals these teachers then began to address the challenge of students who were not reaching their potential in the area of mathematics.

As a result of the group decision making process that lead to Project Math, the math curriculum was redesigned and students were grouped into more successful learning environments. For the plan to work, a third grade teacher, Ms. Terry Knight, volunteered to become the Project Math teacher. In order to prepare for her role, Ms. Knight attended workshops and worked with the math specialist at the school board district office and the math education professor from a local state university to build a foundation of discipline knowledge in mathematical concepts and innovative pedagogy. She then collaborated with the other teachers in order to develop school wide curriculum for the regular classrooms and for the Project Math classes. Ms. Knight became responsible for providing mathematics instruction to the lower achieving students in grade three and four while their classroom teachers taught the higher achieving students. The smaller number of students in these classes enabled her to use math manipulatives and technology in more innovative ways. She was able to relate instruction to students' real world experiences with mathematics by using individualized instruction and enrichment strategies.

Theoretical Framework

The concept of teachers working together as a team innovative leaders, which is key to the Accelerated Schools Project, is not a new one. Dewey (1938) developed the concept of schools as training-grounds for democracy. Lewin (1948) wrote about the importance of small and large groups in empowering individuals to make decisions and work toward goals that improve their own conditions. His research applies to teachers, who as professionals, need to work in democratic situations where they have some influence on major decisions within schools in order

to feel invested in the educational process and its outcomes. It has been demonstrated that in most cases decisions that originate outside the classroom have little impact on how teachers relate to their students or set up the learning environment in their classrooms (Corey, 1953). Therefore, it should be recognized that teachers themselves must be empowered and assisted in their professional decisions so that they can make the kinds of educational changes that are needed for the success of students, and that they are invested in students' success (Cuban, 1993; Sandholtz, Ringstaff, and Dwyer, 1997; and Ward, 2001).

Since the 1960's, philosophical differences about how mathematics should be taught have moved between traditional rote memorization of basic computational skills, and "skill and drill" methods on the one hand and the understanding of mathematical concepts through the use of manipulatives and technology such as calculators and computers which prepare students to solve mathematical problems on the other. While it seems clear that students need to have both computational skills and deep mathematical understandings so that they will be prepared for the problems that they will be asked to solve in the future, classroom teachers have often been required to limit instruction to the memorization of computational skills due to the emphasis on state or national tests, or they have relied on skill based, state funded textbooks that do not expand students' understanding of mathematical concepts. Many have also persisted in teaching in basically the same way they were taught, using only minor variations from rote instructional methods (Cuban, 1993; Ward, 2001).

For students to succeed in today's world however, the role of the teacher needs to change from that of an "expert" who imparts knowledge to "unknowing" student. Instead, teachers need to take the experiential knowledge of students into consideration as they guide them in ways to form concepts and make relationships between mathematical learning and their everyday need to

solve problems. Teachers who can involve their students in understanding mathematical concepts in relation to problems they themselves experience, give them a resource for becoming responsible for their own learning (Ward, 2001; Cole & Sticht, 1981, Kendall & Marzano, 1995). In order to set up learning environments for success, innovative teachers act as scholars, investigating, exploring, and applying strategies based on their understanding of the knowledge of the discipline of mathematics and how people learn mathematical concepts and use them to solve real problems (Glickman, Gordon, Ross-Gordon, 1998).

Methodology and Findings

Several strategies were used to find out the impact of the changes that had taken place in the way mathematics was taught at Thornton Elementary School. Informal interviews were conducted with students currently participating in Project Math and those who were former participants (Attachment A). In addition, formal interviews that consisted of an interview protocol of five questions exploring the changes in student understanding of mathematical concepts and their attitudes toward mathematics, were conducted with four teachers and the principal of Thornton School (Attachment B). Parents of students currently participating in Project Math and parents of former participating students also completed a survey (Attachment C). This data gave the researchers an index of the feelings of the students, teachers, and parents toward Project Math. The researchers also studied standardized test scores, student attendance rates, and the School Performance Score (SPS) as a means of comparing overall achievement during the years 1999-2000 and 2000-2001. Results are reported for the 2000-2001 school year only (Table 1).

In their interviews, students expressed more positive attitudes toward mathematics because of the learner-rich environment provided in Project Math. Classroom teachers also stated that they felt more confident in experimenting with new strategies and ideas for teaching math as a

result of the interactive workshops conducted by Ms. Knight. Teachers reported that the dialogue between classroom teachers and the Project Math teacher encouraged a willingness to share information among the faculty and to collaborate on mathematics enrichment activities.

Table 1 shows the results of the 2000-2--1 state standardized test in math given to the fourth graders. These results show that the number of students who scored in the "unsatisfactory" category in math skills decreased by 50% each year over the last three years since 1998-1999, the period when Project Math was implemented at Thornton Elementary School. There was also an increase in five of the six individual component scores on the math test (Number, Algebra, Measure, Geometry, Date, and Pattern) from scores that were less than satisfactory to scores that approach basic or satisfactory with an increase of +8 in the composite of these scores. These results also show that all of the students who participated in Project Math for two year, both in the third and in the fourth grades, passed the math portion of the standardized test.

Conclusions/Implications

Clearly, Project Math made important contributions to Thornton Elementary School students' mathematical understanding. As a result of lower student-teacher ration, Ms. Knight was able to address the needs of individual students and these students felt encouraged by the individual attention they received from their teacher. Due to the success shown with the third and fourth grade students, the teachers at Thornton Elementary School decided to create another Project Math program for the fifth and sixth grade students for the 2001-2002 school year. Armed with the successful results of their standardized tests, a group of teachers requested of the superintendent that an additional teacher be added to the staff for the upcoming school year. This additional teacher would provide the opportunity for one of the current members of the faculty to become the fifth and sixth grade Project Math teacher. The superintendent was so impressed with

the initiative the teachers took to create a program to improve math instruction that he granted their request.

From this study we can conclude that having fewer students in the classroom and having access to manipulatives makes a difference in math achievement, especially when students have fallen behind in their understanding of mathematics. It also shows that teachers are more confident in teaching mathematics concepts when they have the opportunity to explore learning techniques together under the guidance of a workshop leader. At a school wide level, this study also shows that teachers become more involved in innovative teaching practices when they are included in the decision making processes of the school and therefore, that there is a real need for teachers to have the opportunity to become involved in school change.

TABLE 1
THORNTON ELEMENTARY SCHOOL
Math results from the state standardized test for 4th grade students

School wide scores showing "unsatisfactory" achievement level in mathematics

School year	# of Regular Ed Students
2000-2001	62
Unsatisfactory	5
Percent of unsatisfactory	.08%
1999-2000	46
Unsatisfactory	8
Percent of unsatisfactory	17%
1998-1999	55
Unsatisfactory	18
Percent of unsatisfactory	33%

Levels attained by Students in Project Math
SY 2000-2001

	Number of students	Percent
Unsatisfactory	3*	14%
Approaching Basic	6	29%
Basic	11	52%
Proficient	1	5%

By 2002-2001, the majority of low achieving students had achieved satisfactory levels of achievement. Three still scored in the "unsatisfactory" category, however, they were new to the school and had only participated in Project Math for one year during the 4th grade.

Percentage of students "approaching basic"* achievement level

Sections of the math test: Number	Algebra	Measure	Geometry	Data	Pattern
SY 2000-2001 55	57	43	66	58	55
SY 1999-2000 49	47	58	46	52	51
Composite +8 +6	+10	-15	+20	+6	+4

*Basic is equivalent to a satisfactory score--passing the minimum skills for that grade level.

ATTACHMENT A

Students participating in Project Math Survey

		Yes	No
1.	Do you like Project Math?		
2.	Did you like math before you started Project Math?		
3.	Do you think Project Math helps you do better in math?		
4.	How could the Project Math program be changed to better help you?		

Survey Results

	Yes	No	
1.	33	1	1--a little bit
2.	25	10	
3.	33	5	
4.	Move faster, put cubes on paper and I add it up, more problems, give us worksheets, harder homework, computers/Internet, more problems on the board, help in division, no change.		

Former Project Math Student Survey

		Yes	No
1.	Did you like Project Math?		
2.	Did Project Math help you do better in math?		
3.	Did your math grades improve?		
4.	Do you feel that you have a better understanding of math concepts?		
5.	If Project Math was offered to 5th and 6th grades, would you want to participate?		
6.	Suggestions and comments		

Survey Results

	Yes	No
1.	17	2
2.	18	1
3.	16	3
4.	16	3
5.	10	8
6.	I would like to come back, thank you for helping me, Project Math is "more better."	

ATTACHMENT B
Teacher Survey

Strongly Agree Disagree Strongly

Agree

Disagree

1. Project Math is beneficial to the students.
2. Project Math is beneficial to me as a teacher.
3. Project Math has enabled me to have more one-on-one time with my students.
4. Project Math helps with the discipline in my class.
5. How could the Project Math program be changed to better help students and teachers?

Survey Results

	Strongly Agree	Agree	Disagree	Strongly Disagree
1.	4	1	0	0
2.	4	1	0	0
3.	5	0	0	0
4.	4	1	0	0

5. No comments

ATTACHMENT C
Parent Survey

		Yes	No
1.	Do you think Project Math helps your child?		
2.	Do you think your child's attitude toward math has improved?		
3.	Do you feel your child has a better understanding of math concepts?		
4.	Has your child's math grades improved?		
5.	Do you help your child with homework?		
6.	How could the Project Math program be changed to better help your child?		

Survey Results

	Yes	No
1.	23	3
2.	20	6
3.	20	6
4.	18	8
5.	25	1

Good job the way things are, fine job, no change, help more, send graded papers home so parents can see where weak areas are, mark troubled area on progress report, practice problems are helpful, help kids one at a time, more take home papers for holidays and weekends, one on one, program is doing good, helps children understand.

Parents of Former Project Math Students Survey

		Yes	No
1.	Did Project Math help your child?		
2.	Did your child's attitude toward math improve?		
3.	Do you feel your child has a better understanding of math concepts?		
4.	Did your child's math grade improve?		
4.	If Project Math was offered to 5th and 6th grades, would you want your child to participate?		

Survey Results

	Yes	No
1.	4	0
2.	4	0
3.	4	0
4.	3	1
5.	3	1

REFERENCES

Cole, J.Y. & Sticht, T.G., (1981). The textbook in American society. (ERIC Document Services Record No. ED 225 185).

Corey, S.M. (1953). Action research to improve school practices. New York: Teachers College, Columbia University.

Cuban, L. (1993). How teachers taught. 2nd ed. New York: Teachers College Press.

Dewey, J. (1938). Experience and education. New York: Macmillian.

Glickman, C., Gordon, S.P., Ross-Gordon, J.M. (1998). Supervision of instruction (4th edition). Boston: Allyn and Bacon.

Holmes, J.A. (1999, March 4-5). Elementary teacher perceptions of how the new mathematics standards compare with their current mathematics tests. Paper presented at the Annual Meeting of the Louisiana Educational Research Association, New Orleans, LA.

Hopfenberg, W.S., Levin, H.M., Chase, C., Christensen, S.G., Moore, M., Soler, P., Brunner, I., Keller, B., & Rodriguez, G. (1993). The accelerated schools resource guide. San Francisco, CA: Jossey-Bass.

Kendall, J.S. & Marzano, R.J. (1995). The systematic identification and articulation of content standards and benchmarks. (ERIC Document Services Record No. ED 403 308).

Lewin, K. (1948). Resolving social conflicts. New York: Harper and Brothers.

Sandholtz, J.H., Ringstaff, C., & Dwyer, D.C. (1997). Teaching with technology: Creating student-centered classrooms. New York: Teachers College Press.

Schwartz, W. (1999, July). Family math for urban students and parents. ERIC EDO-UD-99-6.

Third International Mathematics and Science Study (2000). National Center for Education Statistics, U.S. Department of Education. Pursuing excellence: Comparisons of international eighth-grade mathematics and science achievement from a U.S. perspective, 1995, 1999. NCES 2001-028. Washington, D.C.: U.S. Government Printing Office.

Ward, C. (2001). Under construction: On becoming a constructivist in view of the standards. Mathematics teacher, 94(2), 94-96.